

WHAT IS CLAIMED IS:

1. A reflection type liquid-crystal display device comprising:

5 a reflection type liquid-crystal display panel including a liquid-crystal cell and a reflector, said liquid-crystal cell having a visual-side substrate, a back-side substrate and a liquid crystal, said visual-side substrate including a transparent substrate, a transparent layer lower in reflective index than the transparent substrate, and a transparent 10 electrode, said back-side substrate having an electrode, said liquid crystal being held between said visual-side and back-side substrates so that respective electrode sides of said visual-side and back-side substrates are disposed opposite to each other, said reflector being disposed on the back-side 15 substrate side;

at least one illuminator disposed on one of side surfaces of said reflection type liquid-crystal display panel; and

20 an optical path control layer having a repetitive structure of optical path changing slopes on an outer side of said visual-side substrate and being higher in refractive index than said low-refractive-index transparent layer, each of said optical path changing slopes being inclined at an inclination angle in a range of from 35 to 48 degrees with respect to a reference plane of said visual-side substrate.

2. A reflection type liquid-crystal display device according to claim 1, wherein said low-refractive-index transparent layer is disposed between said transparent substrate and said transparent electrode, and there is a
5 difference in refractive index by 0.05 or more between said transparent layer and said transparent substrate.

3. A reflection type liquid-crystal display device according to claim 1, wherein at least said visual-side substrate in said liquid-crystal cell is made of an optically isotropic material.
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4. A reflection type liquid-crystal display device according to claim 1, wherein said liquid-crystal display panel further includes one or two polarizers disposed on one of or
15 each of opposite sides of said liquid-crystal cell.

5. A reflection type liquid-crystal display device according to claim 4, wherein said liquid-crystal display panel further includes at least one layer of phase retarder disposed
20 between said liquid-crystal cell and said polarizer.

6. A reflection type liquid-crystal display device according to claim 1, wherein: said optical path control layer
25 is constituted by a repetitive structure of prism-like

structures; and each of said optical path changing slopes in said optical path control layer faces said illuminator.

7. A reflection type liquid-crystal display device
5 according to claim 6, wherein each of said prism-like structures in said optical path control layer is constituted by a concave portion shaped substantially like a triangle in section.

8. A reflection type liquid-crystal display device
10 according to claim 7, wherein each of said prism-like concave portions is constituted by a continuous groove which extends from one end to the other end of said optical path control layer in a ridgeline direction parallel with or inclined to said side surface of said liquid-crystal display panel on which said
15 illuminator is disposed.

9. A reflection type liquid-crystal display device
according to claim 7, wherein said prism-like concave portions are constituted by discontinuous grooves each having a length
20 not smaller than 5 times as large as a depth of said groove.

10. A reflection type liquid-crystal display device
according to claim 9, wherein the length of each of said discontinuous grooves in said prism-like concave portions is
25 approximately parallel to said side surface of said

liquid-crystal display panel on which said illuminator is disposed.

11. A reflection type liquid-crystal display device
5 according to claim 7, wherein said prism-like concave portions are constituted by discontinuous grooves disposed at random.

10 12. A reflection type liquid-crystal display device according to claim 6, wherein each of said prism-like structures in said optical path control layer is constituted by a concave or convex portion shaped, in section, substantially like a triangle or quadrangle having at least two optical path changing slopes facing said illuminators.

15 13. A reflection type liquid-crystal display device according to claim 12, wherein said illuminators are disposed on at least two of side surfaces of said liquid-crystal display panel.

20 14. A reflection type liquid-crystal display device according to claim 1, wherein said inclination angle of each of said optical path changing slopes in said optical path control layer is in a range of from 38 to 45 degrees.

25 15. A reflection type liquid-crystal display device

according to claim 1, wherein said optical path control layer is made of a transparent sheet, and is bonded to said liquid-crystal display panel through an adhesive layer having a refractive index higher than that of said low-refractive-index transparent layer.

16. A reflection type liquid-crystal display device according to claim 15, wherein said adhesive layer is constituted by a tacky layer.

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17. A reflection type liquid-crystal display device according to claim 1, wherein each of the refractive index of said optical path control layer and the refractive index of said adhesive layer is higher by 0.05 or more than that of said 15 low-refractive-index transparent layer.

18. A reflection type liquid-crystal display device according to claim 1, wherein: at least one side surface of said visual-side substrate is protruded outward from that of 20 said back-side substrate; and each illuminator is disposed on said protruded side surface of said visual-side substrate.

19. A reflection type liquid-crystal display device according to claim 1, wherein each illuminator is disposed and 25 held on said side surface of said visual-side substrate in such

a manner that said illuminator is enclosed by a reflection type light source holder and end portions of said light source holder are bonded to end portions of upper and lower surfaces of said visual-side substrate.

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